

WHAT IS CLAIMED IS:

1. An aldehyde composition comprising a mixture of formyl-substituted fatty acids or fatty acid esters comprising in terms of formyl distribution from greater than about 10 to less than about 95 percent monoformyl, from greater than about 1 to less than about 65 percent diformyl, and from greater than about 0.1 to less than about 10 percent triformyl by weight, based on the total weight of the composition, and further comprising a diformyl to triformyl weight ratio of greater than about 5/1.

2. The aldehyde composition of Claim 1 further comprising from greater than about 3 to less than about 20 percent saturates, by weight.

3. The aldehyde composition of Claim 1 or 2 further comprising from greater than about 1 to less than about 20 percent unsaturates, by weight.

4. The aldehyde composition of Claim 1 wherein the diformyl to triformyl weight ratio is greater than about 10/1.

5. The aldehyde composition of Claim 1 comprising less than about 10 weight percent total heavies impurities.

6. The aldehyde composition of Claim 1 comprising from greater than about 25 to less than about 45 percent monoformyl, from greater than about 20 to less than about 50 percent diformyl, and from greater than about 0.5 to less than about 5 percent triformyl substituted fatty acids or fatty acid esters, by weight.

7. The aldehyde composition of Claim 1 comprising from greater than about 30 to less than about 40 percent monoformyl, from greater than about 25 to less than about 45 percent diformyl, and from greater than about 1 to less than about 2.6 percent triformyl substituted fatty acids or fatty acid esters, by weight.

8. The aldehyde composition of Claim 1 being prepared by a process comprising contacting a mixture of unsaturated fatty acids or fatty acid esters with carbon monoxide and hydrogen in the presence of a Group VIII transition metal-organophosphine metal salt ligand complex catalyst, and optionally free organophosphine metal salt ligand, under process conditions sufficient to convert greater than about 80 weight percent of unsaturated fatty acids or fatty acid esters to monoformyl products.

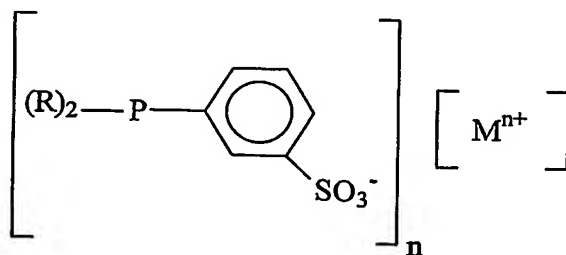
9. The composition of Claim 8 wherein the mixture of unsaturated fatty acids or fatty acid esters is derived from a seed oil.

10. The composition of Claim 8 wherein the seed oil is selected from naturally occurring and genetically modified seed oils of the group consisting of castor, soybean, olive, peanut, rapeseed, corn, sesame, cottonseed, canola, safflower, linseed, sunflower, including high oleic oils, and mixtures thereof.

11. The composition of Claim 8 wherein the temperature is greater than about 45°C and less than about 200°C, and wherein the total pressure is greater than about 1 psia (6.9 kPa) and less than about 10,000 psia (69 MPa).

12. A process of preparing an aldehyde composition comprising contacting a mixture of unsaturated fatty acids or fatty acid esters with carbon monoxide and hydrogen in the presence of a Group VIII transition metal-organophosphine metal salt ligand complex catalyst, and optionally free organophosphine metal salt ligand, under process conditions sufficient to hydroformylate greater than about 80 weight percent of the unsaturated fatty acids or fatty acid esters to monoformyl products, so as to produce a mixture of formyl-substituted fatty acids or fatty acid esters comprising in terms of formyl distribution from greater than about 10 to less than about 95 percent monoformyl, from greater than about 1 to less than about 65 percent diformyl, and from greater than about 0.1 to less than 10 percent triformyl by weight, based on the total weight of the composition, and having a diformyl to triformyl weight ratio of greater than about 5/1.

13. The process of Claim 12 wherein the ligand is a monosulfonated tertiary organophosphine represented by the following formula:



wherein each R group individually represents a radical containing from 1 to about 30 carbon atoms; wherein M represents a metal cation selected from the group consisting of alkali and

alkaline earth metals; and wherein n has a value of 1 or 2 corresponding to the valence of the particular metal cation M.

14. The process of Claim 13 wherein the ligand is selected from the group consisting of the monosulfonated metal salts of triphenylphosphine, diphenylcyclohexylphosphine, phenyldicyclohexylphosphine, tricyclohexylphosphine, diphenylisopropylphosphine, phenyldiisopropylphosphine, diphenyl-t-butylphosphine, phenyldi-t-butylphosphine, and mixtures thereof.

15. The process of Claim 12 wherein the Group VIII transition metal of the complex catalyst is selected from rhodium, ruthenium, cobalt, iridium, and mixtures thereof.

16. The process of Claim 12 wherein the temperature is greater than about 45°C and less than about 200°C, and wherein the total pressure is greater than about 1 psia (6.9 kPa) and less than about 10,000 psia (69 MPa).

17. The process of Claim 12 wherein the carbon monoxide partial pressure is greater than about 1 psia and less than about 250 psia; and wherein the hydrogen partial pressure is greater than about 10 psia and less than about 250 psia.

18. An alcohol composition comprising a mixture of hydroxymethyl-substituted fatty acids or fatty acid esters comprising in terms of hydroxy distribution from greater than about 10 to less than about 95 percent mono alcohol, from greater than about 1 to less than about 65 percent diol, and from greater than about 0.1 to less than about 10 percent triol by weight, based on the total weight of the composition.

19. The alcohol composition of Claim 18 further comprising from greater than about 3 to less than about 35 percent saturates.

20. The alcohol composition of Claim 18 or 19 further comprising from greater than about 0 to less than about 10 percent unsaturates.

21. The alcohol composition of Claim 18 having a diol to triol weight ratio of greater than about 2.5/1.

22. The alcohol composition of Claim 18 comprising less than about 10 weight percent total impurities selected from the group consisting of lactols, lactones, saturated cyclic ethers, unsaturated cyclic ethers, and heavies.

23. The alcohol composition of Claim 18 comprising from greater than about 25 to less than about 70 percent monoalcohol, from greater than about 20 to less than about

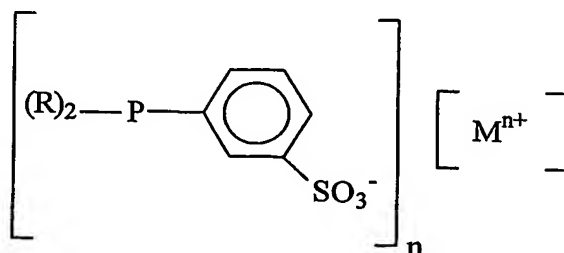
50 percent diol, and from greater than about 0.5 to less than about 5 percent triol substituted fatty acids or fatty acid esters, by weight.

24. The alcohol composition of Claim 17 comprising from greater than about 30 to less than about 45 percent monoalcohol, from greater than about 25 to less than about 45 percent diol, and from greater than about 1 to less than about 4 percent triol substituted fatty acids or fatty acid esters, by weight.

25. The alcohol composition of Claim 18 being prepared by a process comprising (a) contacting a mixture comprising unsaturated fatty acids or fatty acid esters with carbon monoxide and hydrogen in the presence of a Group VIII transition metal-organophosphine metal salt ligand complex catalyst, and optionally, free organophosphine metal salt ligand, under conditions sufficient to hydroformylate greater than about 80 weight percent of the unsaturated fatty acids or fatty acid esters to monoformyl products, so as to obtain a hydroformylation reaction mixture comprising an aldehyde composition of formyl-substituted fatty acids or fatty acid esters; (b) separating the aldehyde composition from the hydroformylation reaction mixture; and thereafter (c) hydrogenating the aldehyde composition with a source of hydrogen in the presence of a hydrogenation catalyst under process conditions sufficient to obtain the alcohol composition.

26. A process of preparing an alcohol composition comprising (a) contacting a mixture comprising unsaturated fatty acids or fatty acid esters with carbon monoxide and hydrogen in the presence of a Group VIII transition metal-organophosphine metal salt ligand complex catalyst, and optionally, free organophosphine metal salt ligand, under conditions sufficient to hydroformylate greater than about 80 weight percent of unsaturated fatty acids or fatty acid esters to monoformyl products, so as to obtain a hydroformylation reaction mixture comprising an aldehyde product of formyl-substituted fatty acids or fatty acid esters; (b) separating the aldehyde product from the hydroformylation reaction mixture; and thereafter (c) hydrogenating the aldehyde product with a source of hydrogen in the presence of a hydrogenation catalyst under process conditions sufficient to obtain the alcohol composition comprising a mixture of hydroxymethyl-substituted fatty acids or fatty acid esters comprising in terms of hydroxy distribution from greater than about 10 to less than about 95 percent mono alcohol, from greater than about 1 to less than about 65 percent diol, and from greater than about 0.1 to less than about 10 percent triol by weight, based on the total weight of the composition.

27. The process of Claim 26 wherein the ligand is a monosulfonated tertiary organophosphine represented by the following formula:



5 wherein each R group individually represents a radical containing from 1 to about 30 carbon atoms; wherein M represents a metal cation selected from the group consisting of alkali and alkaline earth metals; and wherein n has a value of 1 or 2 corresponding to the valence of the particular metal cation M.

10 28. The process of Claim 27 wherein the ligand is selected from the group consisting of the monosulfonated salts of triphenylphosphine, diphenylcyclohexylphosphine, phenyldicyclohexylphosphine, tricyclohexylphosphine, diphenylisopropylphosphine, phenyldiisopropylphosphine, diphenyl-t-butylphosphine, phenyl-di-t-butylphosphine, and mixtures thereof.

15 29. The process of Claim 26 wherein the Group VIII transition metal is selected from rhodium, ruthenium, cobalt, iridium, and mixtures thereof.

30. The process of Claim 26 wherein the hydroformylation is conducted at a temperature of greater than about 45°C and less than about 200°C and a total pressure greater than about 1 psia (6.9 kPa) and less than about 10,000 psia (69 MPa).

20 31. The process of Claim 26 wherein the aldehyde composition is separated from the hydroformylation reaction mixture by extraction.

32. The process of Claim 26 wherein the hydrogenation catalyst comprises a metal selected from the group consisting of Group VIII, Group I, and Group II metals and mixtures thereof.

25 33. The process of Claim 32 wherein the hydrogenation catalyst comprises Raney nickel or supported nickel.

34. The process of Claim 26 wherein the hydrogenation is conducted at a temperature greater than about 50°C and less than about 250°C and at a pressure greater than about 50 psig (345 kPa) and less than about 1,000 psia (6,895 kPa).